

# Movements of Northern Pike tagged in Waters Tributary to Lake Erie<sup>1</sup>

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**ABSTRACT.** Over an eight-year period, 2,659 northern pike (*Esox lucius* Linnaeus) were tagged along the southwestern shore of Lake Erie with monel metal round tags. Of these, 698 were recaptured one to seven years later - 553 by Division of Wildlife nets, 106 by anglers, 22 by commercial fishermen, and 17 were found dead. Sixteen were recaptured four to six times and released before they were removed from the population. Except for a few strays, most of the pike were limited in movement to the area along the shore where they were tagged. The large number of Division net returns, during the month of March (1950-1957), indicate a concentration of pike in East Harbor, or on the spawning grounds.

Three pike taken in Canadian waters illustrate the small segment of the population which is highly mobile. The very few recaptures of pike by anglers and commercial fishermen in Lake Erie, and from 2,603 hours of Division netting in East Harbor from June through September for eight years, suggests a minimum of movement during the hot months of the year. The congregation of breeders and numbers of recaptures in East Harbor during the spring, but a scarcity of them the remainder of the year, indicates a homing trend and suggests a sedentary existence for this pike population most of the year.

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## INTRODUCTION

Northern pike (*Esox lucius* L.) have never been of great commercial or sport fishing value in Ohio waters of Lake Erie. Baldwin and Saalfeld (1960) listed the Ohio commercial landings in 1885 and 1906 as 264,000 and 1,118,000 pounds, respectively. The harvest of 1908 was largely the result of leasing of fishing rights in Magee and other marshes by Lay Brother's Fishery during the spawning season (Jack Lay pers. convers.).

When the Division of Wildlife personnel netted tributaries in the southwestern shore of Lake Erie during spawning season, hundreds of pike were taken. Yet, commercial and sport fishermen harvested only an occasional pike. Ohio was emphasizing the need for large predatory species in the attempt to control an overabundance of pan fish, and the need for trophy sizes of game fish. Fishery agencies around Lake Erie were stressing the need for studies on the movements of all game and commercial species in Lake Erie. Before any attempts were made to manage pike, it was necessary to determine if they remained in Ohio waters throughout the year, or if they were present only during the spawning season.

Many studies of northern pike movements have been made in North America, mostly in the central portion of the native range of the species. McKenzie (1930), Chapman and Mackay (1984), Miller (1948) and Diana et al. (1977) have reported from Canada, Margenau (1986), Schram (1983), and Snow and Beard (1972) from Wisconsin, Moen and Heneger (1971) from the Dakotas, Carbine and Applegate (1948) from Michigan, and Headrick et al. (1982) from Ohio have reported on such movements. Only Schram (1983) studied the movements of pike in a large system—an estuary of Lake Superior.

Studies of fish movements in Ohio started in 1930 with

Wickliff's tagging program in Buckeye Lake and Grimm and Bangham's tagging in Lake Erie (Wickliff 1934). Cummins (1955) conducted Ohio's largest tagging project in 1952 and 1953, when over 60,000 fish of 27 species were marked in the southwestern portion of Lake Erie. This was a part of Ohio's studies to determine the movements of Lake Erie fish. Only 14 northern pike were tagged (Cummins pers. convers.).

Youngs (1958) credited Rousenfell and Kask (1945) with reporting 18 different methods of tagging fish for at least eight different purposes. Shetter (1936) found that mandible tags had no ill effects on tagged brook trout released in Michigan trout streams. Cooper and Benson (1951) reported similar results with brook, brown and rainbow trout in the Pigeon River, Michigan, but Schuck (1942) and Youngs (1958) reported a retarding effect on the growth in brown and rainbow trout. Cummins (1955) reported that Clark had found both normal and abnormal growth in recaptured pike tagged with mandible tags.

## MATERIALS AND METHODS

This study was chiefly conducted in East Harbor, a sandspit pond of approximately 850 acres in the southwestern shoreline of Lake Erie, and separated from it by a large sand bar. They are connected by a wide, natural channel which permits water and fish to move freely between the two. A small ditch, which drains a few acres of orchard and park land, is the only tributary. The harbor is normally less than 2.4 m (8 ft) in depth, but the water level is controlled by that of the lake. The bottom is silt and soft organic debris from the abundance of cattails (*Typha* spp.) along the shore, and the almost choking growth of *Myrophyllum* spp. which reaches the surface in the "open-water" areas.

This study accompanied the netting for northern pike breeders to be used in pike propagation at the St. Marys Fish Farm. They were taken in modified commercial Lake

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Erie trap nets, described by Clark and Steinbach (1959). The best-looking fish were selected for breeders until the desired numbers were reached each day, and the remainder were tagged. The nets were set in March and April from 1950 through 1957, in accordance to the disappearance of the ice cover. They were lifted each morning, the breeders selected and shipped to St. Marys, and the remaining pike tagged and released. Monel metal, butt-end tags were fastened around the lower mandible with tagging pliers supplied by the National Band and Tag Company, which made the tags. Tag sizes from 8-14 were selected and applied in accordance to the size of the fish to be tagged. The marked fish ranged from 36.4 cm (14.3 in) to 89 cm (35 in) in length.

Recaptures in the Division nets were recorded by tag number, date, length, and net number in which recaptured, and then released. In two instances, growth was sufficient that the old tags were removed and replaced by larger ones.

In addition to the 2,457 pike tagged during the spawning season in East Harbor, Rusha and Toussaint Creeks, and Magee Marsh, an additional 202 were tagged in other Lake tributaries such as the Maumee River, Little Cedar Point Marsh, Cooley Canal, and Sandusky Bay.

East Harbor was the only area in which netting for breeders and tagging were conducted in each of the seven years (1950-1957), and the only one in which netting was conducted to obtain information on the status of all fish species. A total of 2,603 hours were fished by these survey nets during the months from June through September, 1950-57. Thus, recaptures by nets were obtained twice per year from the center of the tagging operations.

## RESULTS

A total of 2,659 northern pike were tagged and released at various tagging sites (Fig. 1) from the Maumee River, south and east along the Lake Erie shoreline, to and including Sandusky Bay. Eighteen hundred ninety-nine were tagged in East Harbor, 329 in Toussaint and Rusha

Creeks, 229 in Magee Marsh, and 185 in Sandusky Bay. Only 17 were marked in Little Cedar Point Marsh, Cooley Canal, and the Maumee River.

The greatest number of tag returns came from East Harbor, where 71% of the pike were tagged, and where the survey nets were set each summer or fall. Three hundred ninety-seven tagged pike were recovered at least once in Division nets in East Harbor. One hundred seventeen were recaptured in Division nets in Magee Marsh, 28 in the Toussaint-Rusha area, and 11 in Sandusky Bay.

One hundred six returns came from anglers. Three of these were released by the anglers after they had recorded the tag numbers and recapture site. One of these was caught one year after being tagged, released and taken by the second angler two weeks later, in the same area of the harbor where tagged and taken by the first angler. A second was caught and released by an angler 45 days after being tagged, and recaptured by a second angler 20 days later. Forty-seven angler returns came from East Harbor, where the fishing pressure is the greatest in the area under consideration.

Only 22 recatches were reported by commercial fishermen. Ten of these came from drag seiners in Sandusky Bay, and the others came from nets along the southwest shoreline, except the one from east of Wheatley, Ontario.

Only 17 tags were returned from fish found dead. Fifteen came from East Harbor. Four were found in the first three months after tagging, three in the seventh month, and ten after being at liberty from one to six years. Only one came from outside of East Harbor.

Of the return of 698 pike, 44% were retaken within 90

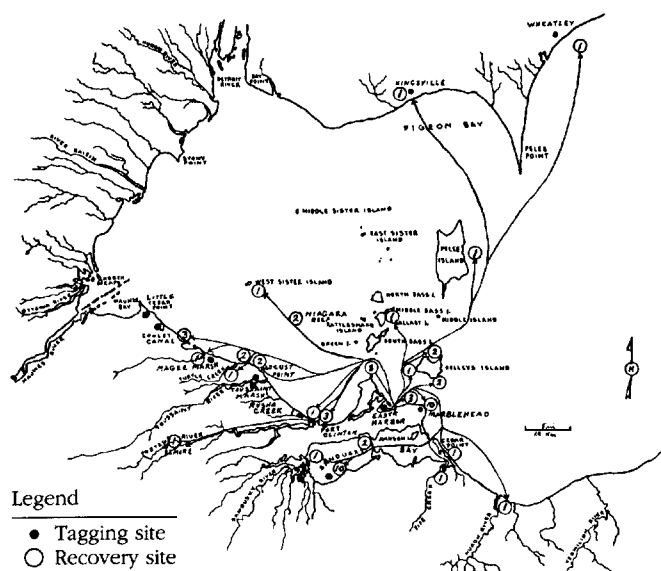


FIGURE 1. Sites at which northern pike were tagged along the southwestern shore of Lake Erie and the recovery sites of the only pike tagged in East Harbor, which were recovered outside the harbor.

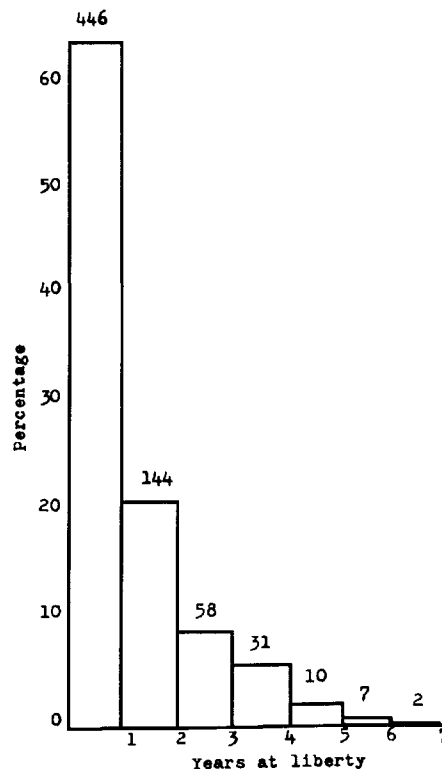


FIGURE 2. Percentages and numbers of pike recaptures presented according to years at liberty after tagging.

days after being tagged, 446 within the first year (Fig. 2), 144 (20.7%) retaken in the second year, and 58 (8%) in the third. Forty-eight (6.8%) of the tagged pike remained at liberty from four to seven years after being tagged. One tagged on 2 March, 1952 in East Harbor, was recaptured in a survey net in the harbor two months later, retaken in Division nets in the springs of 1953 and 1957, and survived to be caught by an angler on 9 April, 1959, all in East Harbor. The rapid decline in the number of recaptures each year after tagging (Fig. 2) is suggested by the reductions of age groups reported by Clark and Steinbach (1959).

The bulk of the recaptures (63.5%) were made in the

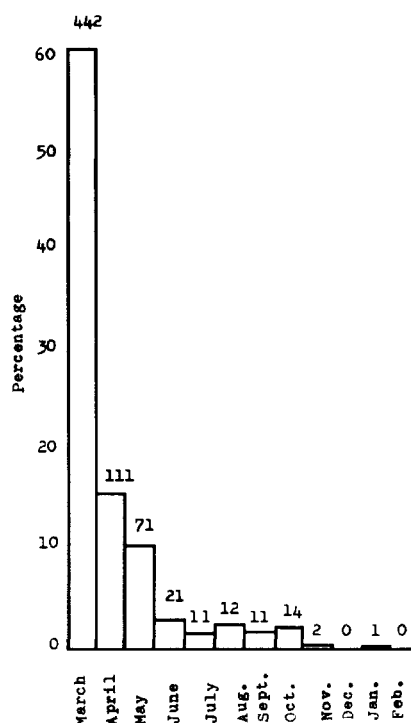


FIGURE 3. Percentages and numbers of pike recaptures presented by month in which recaptured.

month of March (Fig. 2), when the Division nets were taking pike for breeders and tagging. One hundred eleven (15.9%) of the recatches were taken in April, 71 (10%) in May, and 21 (3%) in June (Fig. 3). The recoveries then leveled off to 11 to 14 for the months of July through October (Fig. 3). Only one recapture was taken in January and none in December and February.

Fifty-one (6.7%) of the pike tagged at locations other than East Harbor were recaptured in East Harbor, but less than 1% of those tagged in East Harbor were taken at other tagging locations.

## DISCUSSION

The recapture of 698 (26.5%) tagged pike would seem to provide adequate information to illustrate the movements of northern pike in southwestern Lake Erie. However, 79% of these recaptures came from Division nets, and over 60% were made during the months of March and

April. Only 145 returns were obtained outside of the areas in which they were tagged. Angler, commercial and returns from fish found dead comprised 20.4% of the total returns. Angler returns of 106 (15.2%) compare favorably with a return of 11.2% reported from a compulsory creel census at Buck's Lake, Wisconsin (Snow and Beard 1972), but Moen and Geneger (1971) reported returns from 39.2% from their tagging of pike in Lake Oahe, South and North Dakota, Pringel and Krohn (1975) 17.6% for Big Cedar Lake, Wisconsin, and Schram (1983) 11.3% from an estuary of Lake Superior. Schram attributed his low rate of returns to "... northern pike inhabiting estuaries and large bays of the Great Lakes, are dispersed over a much larger area and probably less vulnerable to angling mortality".

The very low rate of returns from tagged Lake Erie pike during June through February is not consistent with the findings of Diana et al. (1977), who, using ultrasonic transmitters, reported pike to move at random throughout a rather narrow zone most of the year. Chapman and Mackay (1984), using either ultrasonic or radio frequency transmitters in May and June, concluded that "... generalizations concerning the ranging behavior of pike, commonly used in energy budgets and assessments of the quality of prey eaten, are prematurely made". They also reported that others have suggested that pike movement is dictated by the distribution of prey species. These authors found movement of pike throughout the year, and Snow (1978) reported angler harvest as three times as successful in winter than in summer. Yet, Ohio Lake Erie pike were not caught in sufficient numbers by either anglers or commercial fishermen to suggest that they were active in southwestern Lake Erie, except in March, April, and May. Even Schram's explanation could not be applied, for he found July in both 1978 and 1979 to be the peak month of angler harvest. This was not true with Lake Erie pike harvest.

Headrick et al. (1982) wrote "... after temperatures reached 30° C, during the summer, northern pike left the shallow water vegetation and were usually found near the thermocline. They occupied the coolest available water with a dissolved oxygen concentration >3mg/l". These were pike resulting from broodstock selected over a period of more than 25 years, from pike raised in shallow, warm-water fish farm ponds downstate in Ohio. In 1951, 25 pike were placed in a large tank at the Toledo Zoo Aquarium, where the water temperatures were taken daily and varied with the outdoor air temperatures. After the air temperatures reached 24° C (75° F), less than 10% of the white suckers, creek chubs, and perch, introduced as food, were consumed. When the air temperatures dropped in the fall to less than 24° C, the pike became active and the forage began to disappear. In the summer of 1952, nearly 100 pike were speared or snagged from Swan Creek and the Ottawa River, Lucas County, Ohio, during the hot summer months. Only four contained food: one a crayfish, two with one creek chub each, and a fourth a 22.9 cm white sucker.

Trautman and Hubbs (1948) investigated the old myth that pike fishing in the hot months of the year was poor because the fish were losing their teeth, and therefore did not feed well. They cited Michigan creel census which

showed the catch of pike per hour of fishing in the hot months to be about one-half as productive in the July-September period as it was in the May-June period. Johnson (1969) found a higher percentage (over 70%) of Wisconsin pike stomachs were empty from April through July and in September and October than at any other periods of the year. Periods of drastically reduced feeding seem to be common in the literature.

East Harbor tagged pike largely moved in a rather narrow area bordered along the shoreline by marshes, and extending from Little Cedar Point Marsh to, and including, Sandusky Bay (Fig. 1). This area is relatively shallow, under 59.1 m (18 ft) in depth, approximately 8 km wide, with a relatively flat lake bed sloping gently toward the open water of the lake, except in the island and reef areas. Diana et al. (1977) described a somewhat similar area as the summer range for Lac Ste. Anne pike. Headrick et al. (1982) reported "In midsummer, northern pike were most frequently found along submerged creek channels in cover provided by depressions in beds of *Najas minor* and near beds of *Potamogeton americanus* and *P. vaseyi*. *Najas* covered nearly all of the bottom above the thermocline".

The above information indicates that pike concentrate in the coolest water available with sufficient oxygen in midsummer, and seem to be attracted to vegetation, possibly because temperatures are usually lower under the vegetation. Ohio Lake Erie pike are near the southern limits of the natural distribution of pike, and in the absence of cooler water their activities may be reduced almost to levels of aestivation in the marshes. In this condition, they would not be vulnerable to either sport or commercial fishermen. The experimental checks on their activity and feeding in the Toledo Zoo Aquarium tend to substantiate this hypothesis.

Two hundred forty-two of the 698 recaptured pike were taken after one year at liberty (Fig. 2), and 16 of these were recaptured four and five times by Division and commercial nets and sport fishermen before they were removed from the population. There was no correlation between the time at-large, number of times recaptured, and the distance traveled. One pike, tagged in East Harbor, was recaptured four times in that year, and was then caught by an angler in the harbor after seven years at liberty. The record for a pike remaining at liberty was a 49.5 cm (19 1/2 in) one tagged in the Maumee River at Vollmar's Park on 24 October, 1959, and recovered 20 November, 1964 in the same pool in which it was tagged.

In contrast to the above were those pike recaptured in Canadian waters. One taken east of Pelee Island had been tagged three years before, 35.4 km (22 mi) away in East Harbor. The pike taken by a commercial fisherman on 17 March, east of Wheatley, Ontario, was tagged on 7 March, 1951 in East Harbor, about 72.4 km (45 mi) from where it was recaptured. A third pike, caught by an angler in a ditch west of Kingsville, Ontario on 18 April, 1954, had been tagged on East Harbor on 24 March, 1954, a distance of about 64.4 km (40 mi). Moen and Heneger (1971) reported one pike to have traveled 322 km (200 mi) in a very large 131,174 ha (324,000 a) stream-like reservoir in the Missouri River. Schram (1983) reported a maximum distance

traveled by pike in an estuary of Lake Superior as 20 km, and Carbine and Applegate (1948) 79 km (49 mi) in Houghton Lake, MI.

Based on movement in a relatively straight line measure, and distance and time between dates of release and recapture, Moen and Heneger (1971) reported that 1.6 km (1 mi) per day was not uncommon speed of travel, and that 3.2 km (2 mi) per day for 240 km (150 mi) was the maximum in their study. The record for speed of movement of Lake Erie pike was set by one which was tagged in East Harbor about 9 A.M. in the morning, and recaptured in Sandusky Bay by a drag seiner in the afternoon, a distance of about 27.4 km (17 mi).

The direction of movement of the Lake Erie pike, taken outside of East Harbor (Fig. 1), could best be described as correlated with the contour of the shoreline, along which they moved from one tributary marsh to another. This shoreline, as comprised of thousands of acres of marshes which might be considered as one spawning ground, is made up of distinct units of more desirable spawning habitat, of which East Harbor appeared to be the best. Approximately 8% of the pike tagged in Sandusky Bay, 6% from the Toussaint-Rusha Creek area, and nearly 7% from Magee Marsh were recaptured in East Harbor, whereas only 1% of those tagged in East Harbor were recaptured in the other tagging areas. Only 63 of the 1,899 pike tagged in East Harbor were recaptured outside the harbor, and only 12 can be considered as moving away from the spawning grounds, reaching from Sandusky Bay to Little Cedar Marsh.

Gerking (1959) found an average of 80% of the marked fish, in his study of the movements of stream fish, remained or were recaptured within the same pool from one year to the next. Funk (1957) described both a "sedentary" and a "mobile" group of fish within the same population. The return data from Lake Erie pike are in agreement with both of these observations. The majority of the returns came from close to the sites of tagging, and either indicate little movement or a homing instinct to return to the same spawning areas in consecutive years.

## CONCLUSIONS

Ohio's Lake Erie pike population is, generally speaking, a population restricted rather closely to the Ohio waters of southwestern Lake Erie. The extremely sedentary nature, which borders on aestivation in the hot summer months, is probably because of this population existing in the southern border of the native range of the species, the high summer temperatures, and the lack of cool oxygenated water in neighboring areas into which they can move.

This relatively large population of pike appears to be present in Ohio waters throughout the year, but are not being harvested by anglers because of their drastically reduced activity and feeding habits during the summer months. The presence of this rather large "resident" population in the shallow water habitat of southwestern Lake Erie was responsible for the decision of the author to instigate a selective breeding program to develop a strain of pike better adapted to the warmer waters of inland Ohio.

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